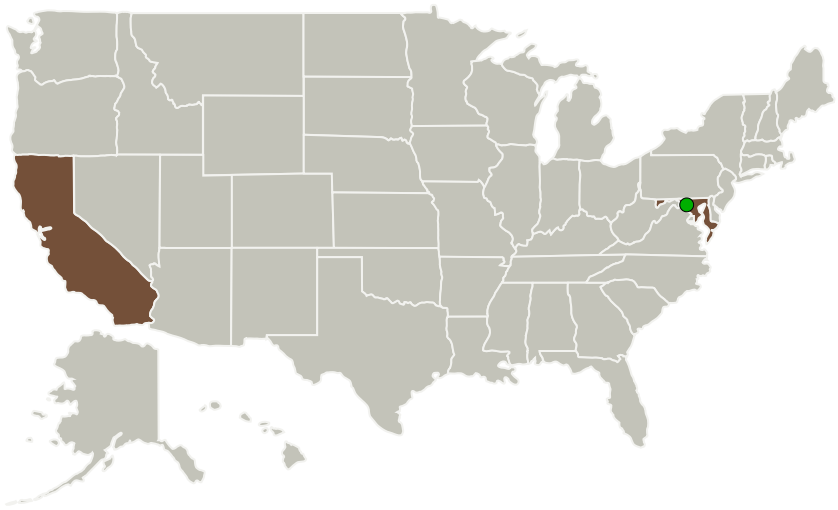
A 10kWatt 36GHz Solid-State Power Amplifier using GaN-on-Diamond, Phase II

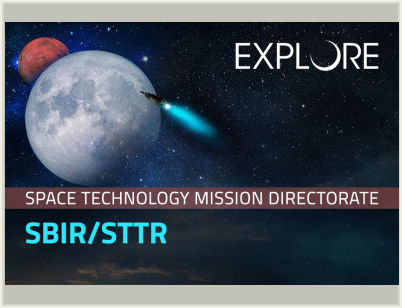
Completed Technology Project (2010 - 2013)

Project Introduction

This Phase-II SBIR proposal proposes for the first time ever, the use of a new class of materials - Gallium Nitride-on-diamond - in the manufacture of very high power, high-temperature, Ka-band solid-state MMICs. In this particular Phase-II, the first ever 34-38GHz GaN-on-Diamond FETs will be demonstrated, exhibiting a record 5-10 W/mm at record efficiency and temperature levels. Arrays of these FETs will be used to form (power combined) 10KWatt Power Amplifiers (PA) MMICs. Polycrystalline free standing CVD diamond ⬭ nature's most efficient thermal conductor ⬭ enables nearly perfect heat extraction from a "hot" device (Thermal conductivities of GaAs, Si, and SiC are 35W/m/K, 150W/m/K and 390W/m/K respectively; diamond ranges from 1200-2000 W/m/K depending on quality). In the proposed scheme, the device's active epitaxial layers are removed from their original substrate and transferred to a specially treated low-cost CVD diamond substrate using a proprietary low-cost manufacturable scheme. The active junction rests just 20-nm from diamond. The semiconductor-on-diamond technology proposed here may be applied to GaAs, SiC, SiGe, etc. at up to 8" in wafer diameter.

Primary U.S. Work Locations and Key Partners





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Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Group4 Labs, LLC	Lead Organization	Industry	Menlo Park, California
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
California	Maryland

Project Transitions

February 2010: Project Start

May 2013: Closed out

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Group4 Labs, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

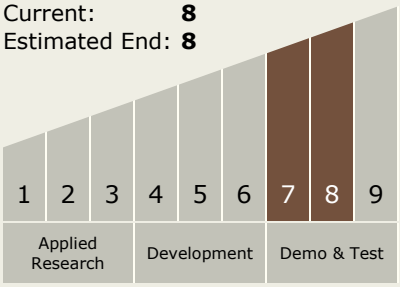
Carlos Torrez

Principal Investigator:

Felix Ejeckam

Technology Maturity (TRL)

Start: **7**
Current: **8**
Estimated End: **8**



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Completed Technology Project (2010 - 2013)

Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.2 Radio Frequency
    - TX05.2.7 Innovative RF Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System